MATH 601
Stochastic Differential Equations and Applications

Instructor: Dr. Boubaker Smii

BOOK:

  [1] B. Øksendal, Stochastic Differential Equations: An Introduction with Applications. 6th Edition. Springer 2010.

 Course Description: Probability spaces, characteristic functions, stochastic processes, martingales, Markov Chains, Brownian motion, Itô calculus, Itô formula, stochastic differential equations, applications of stochastic differential equations.

Pre-requisite: Math 531 or Instructor's Consent

COURSE OBJECTIVES

Stochastic processes and stochastic differential equations play a basic and steadily growing role in the description of phenomena occurring in the natural, technical and economical world.

The main objectives of the current course are:

* Provide the students with the basic mathematical instruments for the understanding of this important area of mathematics.

 * Give them access to a very active area of contemporary mathematical research.

* Put them in a position to actively handle problems arising from real world applications.

COURSE OUTCOMES

*Students will be able to analyse and solve some stochastic differential equations.

*They will have the basis for profitably attending future lectures related to more advanced topics and use SDE's in research, both at universities and industrial institutions.

* They will be at ease in handling problems in various areas of science, engineering and technology.

Syllabus:

Week	Date	Section	
1	Feb.5-9	1	1.1 σ-algebra, probability measure, probability spaces
2	Feb.12-16	2	2.1 Real and vector valued random variables 2.2 Standard results of measure and integration theory
3	Feb.19-23	3	3.1 Characteristic functions 3.2 Properties of characteristic functions
4	Feb.26-28	4	4.1 Stochastic processes
5	Mar. 5- 9	4	4.2 Martingales and Markov Chains
6	Mar.12-16	4	4.3 Brownian motion: Defining properties 4.4 Processes derived from Brownian motion
7	Mar.19-23	5	5.1 The Riemann-Steiltjes integral 5.2 Itô stochastic integral: A motivating example
8	Mar.26-30	5	5.3 Itô stochastic integral for simple processes
	April. 2-6 : **Mid-term Break**		
9	Apr.9-13	6	6.1 Itô formula: A simple version of the Itô lemma
10	Apr.16-20	6	6.2 Extended version of Itô lemma
11	Apr.23-27	7	7.1 Stochastic Differential equations (SDEs)
12	Apr.30-May.4	7	7.2 Solving SDEs
13	May.7-11	7	7.3 Linear stochastic differential equations
14	May.14-18	8	8.2 Applications of SDEs
15	May.21-25	8	8.2 (cont.) Applications of SDEs

Grading policy:

Exam I: 35%   **HW&Projects: 25%**

Final Exam: 40%